

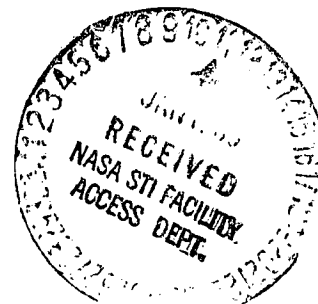
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User Requirements for a Patient Scheduling System

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Prepared for
Rehabilitation Institute
Detroit, Michigan
by
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California



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16. Abstract The Rehabilitation Institute in Detroit, Michigan, has indicated that, due to its present and projected growth in patient workload, it does not feel that the goals of the Institute are being met by the existing scheduling system. In considering a modification or replacement scheduling system as the ultimate goal, the first step was to establish the Institute's needs and wants from a scheduling system. This phase was accomplished through 1) studying the existing scheduling system and the variables that affect patient scheduling, 2) conducting a human-factors study to establish the human interfaces that affect patients' meeting prescribed therapy schedules, and 3) developing and administering a questionnaire to the staff which pertains to the various interface problems in order to identify staff requirements to minimize scheduling problems and other factors that may limit the effectiveness of any new scheduling system.			
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tion.

ABSTRACT

The Rehabilitation Institute in Detroit, Michigan, has indicated that, due to its present and projected growth in patient workload, it does not feel that the goals of the Institute are being met by the existing scheduling system. In considering a modification or replacement scheduling system as the ultimate goal, the first step was to establish the Institute's needs and wants from a scheduling system. This phase was accomplished through 1) studying the existing scheduling system and the variables that affect patient scheduling, 2) conducting a human-factors study to establish the human interfaces that affect patients' meeting prescribed therapy schedules, and 3) developing and administering a questionnaire to the staff which pertains to the various interface problems in order to identify staff requirements to minimize scheduling problems and other factors that may limit the effectiveness of any new scheduling system.

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PREFACE

This report has been prepared for the Rehabilitation Institute in Detroit, Michigan, in accordance with the guidelines established under JPL Proposal 70-1134. The primary objective of this task was to provide the Rehabilitation Institute with a set of documented requirements for a patient and resources scheduling system.

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I. SUMMARY

The Rehabilitation Institute in Detroit, Michigan, has indicated that, due to its present and projected growth in patient workload, it does not feel that the goals of the Institute are being met by the existing scheduling system. This assessment is based on the impact presently being experienced by the Institute in the form of 1) extended delays between patients' requests for appointments and confirmations, 2) patient schedule changes' not being transmitted in a timely manner to all involved parties, resulting in patient nonappearance (or unavailability of therapists), and 3) periodic idleness of treatment areas and equipment. Such schedule upsets degrade the ability of the hospital to care for patients and result in lost revenue since the hospital cannot bill for therapy not administered.

With a view to redesigning or replacing the existing scheduling system, the first activity was to establish the Institute's scheduling system needs and to document those needs as "system requirements."

In order to develop the requirements for a scheduling system, a human factors study was conducted to ascertain the primary possible human interface problems affecting the scheduling of patients. The results of this study were used to construct a questionnaire for the Institute's entire staff with the aim of identifying their needs and those of the patients to help minimize the respective scheduling problems. The questionnaire was also designed to focus on other peripheral problems (such as workload and equipment problems) not necessarily part of the scheduling system but which, nevertheless, affect the ability of the staff and the patients to meet schedules.

In summary, the results of the questionnaire indicated the following:

- (1) The patient capacity of the Institute will be growing at a fairly rapid rate.
- (2) The Institute desires to assume responsibility for billing, patient accounting, and access to medical records.
- (3) Diagnostics requires access, on demand, to doctors' schedules, patient locations and means of transportation, and patient schedules (if treatment is already started) in order to effectively match doctor and patient schedules.

- (4) Schedule design and transmission of schedule changes by the therapy and nursing staffs and the scheduling department must be accomplished within one day in order to minimize confusion and delays in the patient care cycle.
- (5) More complete information on patient physiological and psychological condition is desired.

The questionnaire results also indicated that patients needed at least 15 minutes to get to their respective therapies, that some patients with certain types of disorders require more preparation time in the morning, and that other patients can endure only limited therapy sessions before their physical limits are severely taxed. The impacts of these results are, respectively, that some patients are delayed in meeting their therapy schedules, and that some may not attend or may be late for their following therapy sessions.

The questionnaire explored other peripheral variables (e.g., workload and equipment) that affect scheduling. These variables were examined from the standpoint of determining whether or not they could be limiting factors affecting the efficiency of the scheduling system.

Preliminary findings of the questionnaire indicate the following:

- (1) Considering the present staff size and cyclic attrition pattern, as matched against the present and expected growth in patient capacity, the Institute could experience a mismatch in staff-patient workload at times of staff illness or small changes in the influx of patients.
- (2) Failure or nonavailability of elevators (the prime means of patient transport) and select therapy and medical equipment could affect patients' receiving their respective therapies at scheduled times.

The final recommendations provided to the Institute were:

- (1) Analysis should be done to determine possible staff, equipment, or space constraints that the hospital may have to resolve, given the expected growth to that of accommodating 575 patients daily.
- (2) The desired additional information capabilities should be defined in more detail (e.g., the maximum number of daily sessions each patient may have, the maximum number of daily appointments physicians and therapists may have, the presentation format of medical records, etc.).

- (3) A methodology should be established for evaluating potential replacement scheduling systems.
- (4) A request for proposal (RFP) should be assembled which contains all of the system requirements. Interested contractors should then be solicited to respond to the RFP and provide proposals in a format commensurate with the evaluation methodology.

In addition to the above-stated requirements, it was also recommended that the Institute define, in more detail, some of the areas addressed in the study. Those areas center around the impact of transportation as a limiting factor affecting the movement of patients, the relationship of patient disability to endurance of therapy and required morning preparation time, and the establishment of a logistics support study of elevators and hospital equipment failures to reduce the impact of these variables on successful completion of therapy as scheduled.

II. INTRODUCTION

Human-factors engineering is defined as the study of the interface between human beings and systems. Historically, human-factors engineering has dealt with time-efficiency studies as related to optimizing a worker's performance in the operation of production machinery (i.e., assembly lines). The military has also made extensive use of human-factors engineering in terms of matching operator performance and limitations with high-technology systems performance such as that of aircraft. More recently, the area of human-factors engineering has been expanded considerably to include systems such as transportation, environmental (such as health studies in coal mining), and medical (such as implantable devices, prostheses, etc.). The present thrust of human-factors analysis is to design systems which will allow the human being to operate safely, efficiently, and comfortably within (or in conjunction with) those systems.

As an adjunct to the field of human-factors engineering, systems analysis plays a major role in evaluating or designing systems to consider the human being. Systems analysis provides the means through which a new system is designed and developed. The essential steps necessary in designing a new system are:

- (1) Define systems requirements (or performance criteria) and constraints.
- (2) Describe system functions.
- (3) Describe, in detail, operational event sequences.
- (4) Describe component processes.

- (5) Match human requirements with the total system operational characteristics.

A. Human Factors and Systems Analysis as Related to the Hospital Scheduling Problem

If one considers the Rehabilitation Institute and its means of scheduling patients as a system, that system is composed of the following components:

1. Scheduling system (from a procedural standpoint)
2. Staff using the system (scheduling department, physicians, therapists, clinicians, admitting and diagnostics staff, nursing staff, etc.)
3. Patients (both in- and out-patients)
4. Peripheral components related to equipment used to move patients to and from therapies to meet schedules, and equipment used during therapy and other patient-care periods that provide necessary patient service

The Rehabilitation Institute is housed in an eight-floor annex to Harper General Hospital. The therapies and clinics are located on the first, second, and fifth floors; they are segregated from the patient floors located on the third, sixth, and seventh floors. The fourth floor will eventually also become a patient floor. The eighth floor is the location for the administrative offices. The Institute is presently operating at a capacity of approximately 135 in-patients and 145 out-patients. This is complicated by the fact that there is a waiting list to get into the hospital. Although the patients are generally in a stable condition upon admittance, most of them require some type of assistance (e.g., wheelchairs, mobile stretchers) in order to move about. Because patient floors are segregated from therapy floors, patients must depend on the elevators to move from one activity to the next. Once in the Institute, however, patients do not have to leave the therapy complex unless special tests, such as X-rays or surgery, have to be performed.

Basically, patients are referred to the Institute and scheduled for evaluation by appointment. At the time they arrive, they are formally admitted, then evaluated by a physician. At this time, the physician writes up orders prescribing various therapies and patient-care requirements. Once the scheduling department receives official notice of the admittance, a patient file is made and the orders transmitted to the various therapies and nursing staff involved. The detailed patient-scheduling cycle, which is done manually, then commences.

In the scheduling process, the various therapies and clinical services coordinate with the scheduling department, and each other, to fit patients into available time slots. The scheduling department receives all the scheduling inputs and adjusts any remaining conflicts prior to forwarding a final patient schedule to the involved therapies, clinics, nursing staff, and related services. A similar procedure is undertaken to process schedule adjustments due to changes in doctors' orders or patient complications. At this time, however, the procedure becomes exceedingly more complex due to the "domino" effect of having to change other patient schedules as well.

The present manual system of performing the activities described above works very well for a small number of patients. Due to the existing in- and outpatient capacities and the planned growth of the Institute, however, it is difficult to process new schedules and schedule changes in a timely fashion under the present system. The impacts have been felt when there are 1) extended delays between requests for appointments and confirmations and 2) schedule changes have not been passed on to all involved parties quickly enough to ensure patients' arriving for therapy at the proper time, or to enable therapists and the nursing staff to be available for patient care at the proper time. Needless to say, these problems relate directly to loss in revenue.

Therefore, in viewing scheduling from an overall systems standpoint, the major problem appeared to be one of communicating scheduling data among several groups of people within a time-frame that eliminates delays and confusion with the patient-care cycle. Also, other factors could impact the effectiveness with which schedules, once established, would be adhered to. Primarily, these factors are workload (in the management area) and equipment (availability is the prime variable). Since all of the above-stated systems components affect scheduling, a total systems approach appeared to be the most effective way of examining the problem. Furthermore, since the communication and potential workload and equipment dealt, respectively, with human-human and human-machine interfaces, a human-factors approach appeared to be the most effective means of examining and establishing a framework to resolve the scheduling system problem.

III. APPROACH FOR DEVELOPING THE SCHEDULING SYSTEM REQUIREMENTS

As stated in the previous section, the first step in developing the scheduling system was to delineate system requirements or performance criteria. As a scheduling system was already in existence at the Institute, information was available on how the system basically functioned, the event sequences, and how the various components of the system operated. The task was then to perform an iteration on the original requirements that would ultimately allow the existing system to be upgraded to meet existing and projected needs. Therefore, given the available

information, it was decided that the most expeditious approach would be to 1) examine the existing system to gain a good understanding of how it operated, 2) determine where potential delays could occur in communicating information or providing patient service, and 3) develop system requirements based on what the various people who experienced the delay problems perceived were necessary to alleviate or minimize these problems.

The first step in the approach was accomplished during a two-week visit to the Institute, which provided a concentrated orientation of the organization and its operation. The orientation was conducted using an interview-type process wherein the human-factors analyst questioned the director, several staff people in each of the various departments, and patients. The following four major questions were asked of the staff people from the various departments:

- (1) What is your present staff level and how does it fluctuate?
- (2) What are the basic operations and tasks your department performs?
- (3) How do you schedule patients or interface with the scheduling system in the performance of your functions?
- (4) What kinds of problems do you experience with scheduling patients and in providing your service to them in accordance with a schedule?

The following questions were asked of upper management:

- (1) How, and at what rate, do you see the Institute growing in terms of patient capacity?
- (2) What are the goals you would like to achieve through a new scheduling system?

The primary question asked of patients was:

What are the major problems you experience in trying to meet schedules assigned to you by the Institute?

It should be emphasized that the intent of this interview process was not to pinpoint scheduling problems in the Institute, but to understand how the organization operated and where potential problems could occur. Given the relatively small sampling of opinion from the few people interviewed, it was not assumed that all information provided necessarily revealed the major causes of scheduling delays.

The information gathered from the interviews was used to understand the various human and equipment interfaces associated with patient scheduling and to establish a framework to further question the entire staff (insofar as possible) on what requirements related to a scheduling system it deemed necessary to resolve the potential interface problems. To this end, a flow chart was developed (Fig. 1) which depicted the various events and potential interface problems related to the scheduling system. The information in Figure 1 was then used to develop a more comprehensive questionnaire to query the staff on what it considered acceptable alternatives to resolve potential interface problems. The final tabulation of the questionnaires would then provide the performance requirements for a new or updated scheduling system.

A. Questionnaire Design

The questionnaire was tailored to each department involved with the scheduling procedure. Based on the inputs received from upper management during the two-week interview period, the questionnaire was designed to essentially formalize the various ways through which the Institute would be expected to grow. The results of this questionnaire would be used to establish the kinds and amount of information a scheduling system would ultimately have to process and provide.

The interviews with some of the physicians indicated that most of the potential scheduling delays involved access to medical records in order to complete initial evaluations or make changes during the patient-care cycle. Therefore, the questionnaire was designed to explore an acceptable time interval to gain access to records such that the disruptions in patient therapy and care would be minimized.

Interviewing the staff of the various therapies and satellite clinics provided excellent insight into a number of variables that could potentially cause scheduling delays. These variables centered around 1) the time required to go through the actual mechanics of scheduling patients, 2) the time required to get a confirmed patient schedule back from the scheduling department, 3) incomplete knowledge of the physiological and psychological states of the patient, 4) the managing and tracking of day-to-day patient schedule changes, 5) the infringement of other workload variables (such as reports, meetings, and updating patient status sheets) on respective therapies and patient workloads, 6) the management of the patient workload, and 7) equipment availability and breakdown. As a result, the questionnaire was designed to establish what the staff felt were acceptable turnaround times for scheduling information inputs and feedbacks, and whether or not the workload and equipment variables could have an impact on meeting established therapy schedules.

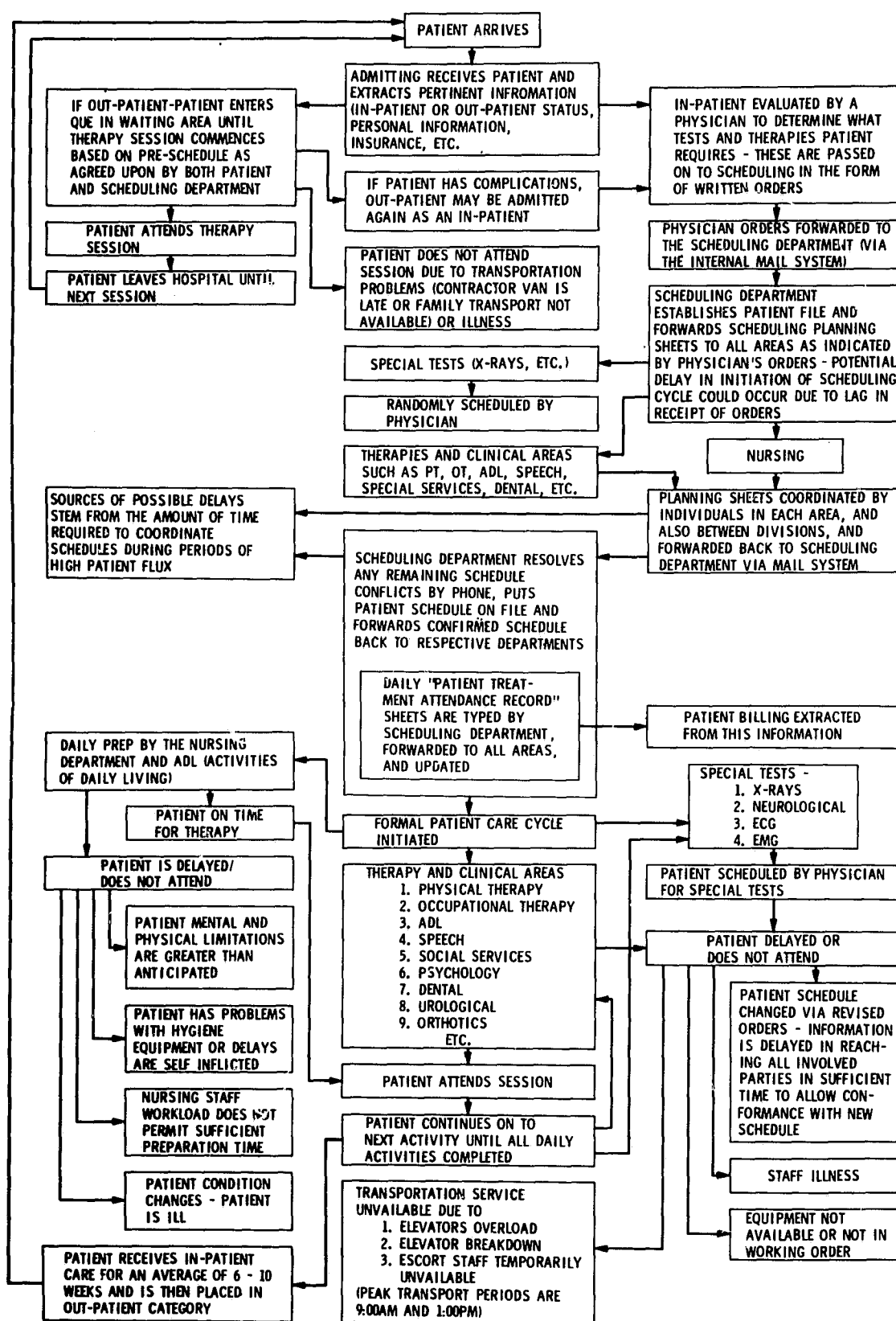


Figure 1. Scheduling System Flow of Events

It should be noted that, in designing questionnaires for determining what kinds of improvements should be made to a system, it is important to provide the participants with a framework for comparing the existing system with an as-yet-undefined replacement system. The framework should allow the participants to extrapolate operational requirements for the replacement system. A viable way to achieve this is to 1) identify the circumstances under which delays, as associated with the above-stated variables, could result, 2) consider extreme circumstances that would require the staff to perform at peak efficiency in order to complete tasks in an optimal manner, and 3) request that the answer (or performance requirement) provided on the questionnaire reflect what that optimal task time, or system response time, should be to offset the extreme circumstance and therefore minimize any delays. In this manner, a replacement system designed to meet these new performance criteria would resolve the worst possible problems causing delays in scheduling and in servicing patients.

Some examples of extreme situations provided the therapy and clinical staffs for the purpose of comparison and requirement extrapolation were as follows:

- (1) What is the recommended time required to perform the mechanics of patient scheduling (as well as schedule changes) considering periods of excessive patient-scheduling workload?
- (2) What is an acceptable period of time to obtain feedback on patient delays, no-shows, or cancellations such that patients can be located and delivered or rescheduled to allow the daily therapy schedule to be followed as planned?
- (3) What is an acceptable time interval to redistribute the daily patient workload (in the event of staff illness, etc.) so that all patients receive treatment as scheduled?

Those areas in the questionnaire that addressed possible workload and equipment problems that could affect patients' receiving therapy, or arriving at therapy sites, were addressed simply from the standpoint of the degree to which the staff felt these problems existed. During the initial stage of developing system performance requirements, it was sufficient to understand that variables such as these could be limiting factors affecting the success of any new scheduling system established to alleviate scheduling problems.

The questionnaire designed for the nursing staff and floor clerks (who act as major information transfer points for passing on schedule changes and physicians' orders to the nursing staff) was designed to be similar to the therapists' questionnaire.

However, as patient condition and patient workload arose as potential variables affecting patients' meeting established schedules, these variables were examined in more detail. For example, the nursing staff were requested to respond to the following statements to establish how patients should be scheduled and acceptable feedback intervals to ensure timely patient delivery to meet required schedules.

- (1) Are patient condition and respective disabilities major factors in morning preparation and in meeting the first morning activity? If so, list the major disabilities (and respective preparation times) in their order of difficulty.
- (2) What is an acceptable feedback interval on schedule changes to insure patient delivery at the proper time for a given activity?

The interviews with the floor clerks indicated "workload" as a potential problem affecting their ability to act as information transfer points for passing on physicians' orders and schedule changes. Therefore, the floor clerks' section of the nursing staff's questionnaire essentially probed their respective tasks, task priorities, the time required to organize patient schedule changes, and the number of schedule changes requiring coordination on a daily basis.

The scheduling department interview provided background to the effect that the actual mechanics of scheduling, and of tracking and transmitting schedule changes, could potentially cause backlogs in getting confirmed schedules out to the various departments. Subsequently (as on the therapists' questionnaire), extreme situations relating to periods of excessive scheduling and workload, or management of schedule changes to minimize disruptions in patient schedules, were provided for the purpose of establishing system performance requirements.

Again, the diagnostics questionnaire was developed using the framework for comparison of potential scheduling backlog under conditions of extreme new-patient admittances. In the case of the diagnostics department, one additional potential problem affecting the process of getting patients scheduled for initial evaluation was the lack of information regarding doctors' and patients' schedules. Therefore, the questionnaire also examined what additional information was required to process new admittances more efficiently.

The building and equipment maintenance staffs were queried about equipment maintenance as a potential factor affecting the ability to move patients to therapy sites or to administer therapy through the use of equipment. The intent of this questionnaire was to determine whether or not equipment failure during patient

therapy and care periods affected the Institute's ability to provide service.

Closely related to equipment (in terms of moving patients) is the transportation department and its function of moving patients to and from the elevators. Discussions with the transportation department indicated workload and equipment breakdown as the major potential problems affecting its ability to get patients to therapy sites as scheduled. As a result, the questionnaire was designed to probe possible limiting factors such as the frequency of elevator breakdowns and mismatches between the rate at which patients must be delivered and the staff that is available to deliver them.

The last questionnaire was for patients. Its basic structure was centered around what patients feel are major sources of scheduling delays. The essential concept here is that any replacement scheduling system must give first consideration to the needs and well-being of the patients. A system which simply provides for scheduling changes based on equipment and staff personnel availability may not consider patient limitations. Trying to meet schedules established for them without their inputs is to deal with only part of the picture.

The above-stated framework provides the reader with an idea of the basis around which the questionnaires were developed. The complete questionnaire package is shown in Appendix A.

B. Questionnaire Results

The preceding section describes the design of the questions and how the information obtained from the initial interviews was used to develop the various areas addressed in the questionnaires.

Once the questionnaires were developed, the next step was to distribute them. Due to funding and time constraints, it was impossible to follow the normal procedure for designing and testing questionnaires to insure consistency in the responses. Therefore, to guarantee a reasonable degree of consistency in the answers, a second visit was made to the Institute with the purpose of explaining the questions to the participants. At the completion of this effort, the various staff areas were prepared to complete the questionnaires. Unfortunately, a two-week delay occurred in the distribution and completion of the questionnaires, due to the travel commitments of various Institute individuals who administered the questionnaires. In anticipation of possible problems due to the time-lag and the participants' not understanding or remembering the intent of the questions, a final follow-up trip was arranged after the results were tabulated. Polarization of the sample population on some of the questions indicated that perhaps the two-week lag had an effect on how these questions were

interpreted. The follow-up trip confirmed this as the source of the polarization, and the final results were adjusted accordingly.

The final results of the questionnaire are provided in detail in Appendix B. The information provided in the form of decimal figures (.80, .70, etc.) is the fraction of responses. The answers related to the fractions are in parentheses.

1. Statistical Tabulation of Results

In an effort to provide the results in a more compact form, the questions were grouped and tabulated in three main categories: scheduling-system-related, workload-related, and equipment-related. The reader will note that Appendix B is organized in this manner.

The respective sizes of the populations sampled in each department are shown in Table 1.

Table 1. Comparison of Population-Sample Size to the Approximate Department Size

Participating Area	Approximate No. of People in Dept. (Day-Shift)	No. of Questionnaires Returned
Upper Management	4	2
Physicians	14	9
Scheduling Dept.	4	3
Admitting	1	1
Diagnostics	2	2
Therapies/Clinical Services	66	43
Nursing Dept.	83	27
Transportation	14	1
Bldg. Maintenance	3	1
Equipment Maintenance	1	1
In-Patients	125	35

In view of the extremely demanding schedules of the staff (particularly those of the physicians, therapists, and nurses), the response to the questionnaires was considered sizeable. The patient response was also considered significant in view of the sensitivity one must exercise when administering a questionnaire to people who are not well. The actual statistical significance of the sample populations is extremely difficult to measure meaningfully because of the relatively small total and sample populations (e.g., the day-nursing staff is the largest group, containing only 83 people). The answers provided by the nursing staff pertaining to the ranking of disabilities by preparation difficulty and time indicated an average standard deviation of one hour. If one recognizes the fact that a ten- or fifteen-minute error in the actual preparation time could mean the difference between billing or not billing for therapy, then the allowable statistical error would be ten minutes (.17 hours). The preferable level of confidence for statistical population sampling is 95 percent. The following standard confidence interval equation applies:

$$E = Z \frac{\sigma}{\sqrt{N}}$$

where

E = allowable error (in hours)
 Z = confidence level factor (1.96 for 95% confidence)
 σ = standard deviation (hours)
 N = population sample size

Plugging in the above values and solving for N indicates that one would have to sample a population of 133 nurses in order to be 95 percent confident that the ranking and preparation data were accurate. Obviously, the total day staff is considerably smaller than the sample required.

As the problem of small sample populations applied to a number of questions, it was decided to view the significance of the responses from another standpoint: namely, that the hospital staff deal constantly with the day-to-day variables affecting scheduling. Therefore, they have the best exposure to, and knowledge of, these variables. Subsequently, a large response in favor of a particular requirement to resolve a potential scheduling problem is significant in that a large group of people (large in terms of the Institute population) concur on the resolution of the problem. As a side note it was observed, on key questions relating to system response requirements, that the standard deviation in the answers was small enough to provide 95 percent confidence in the responses even though the sample populations were small.

2. Key Results of the Questionnaire

The following discussion provides the reader with the questionnaires' key elements that relate directly to the development of performance requirements for a scheduling information system.

a. Upper Management

The results of the upper management questionnaire relating to Institute growth indicated a planned increase to 175 in-patients by 1984. The desired time frame to be able to handle the expected out-patient growth was not defined. However, the desired capacity was stated to be 400 out-patients per day. In terms of additional growth, the Institute is also considering establishing satellite therapy mini-centers on other floors to handle patient overflow. Therefore, the total patient capacity that the Institute must ultimately accommodate is 575 per day.

The upper management questionnaire indicated a desire to have other information available in conjunction with scheduling: namely, patient billing, patient accounting, and medical records.

b. Physician

The statistics for the physicians' questionnaire indicated the following results as related to scheduling of patients for evaluation.

- (1) Sixty-six percent felt that an initial delay of 15 to 60 minutes for evaluation should be designed into the scheduling of patients. This delay time could be used to give new admittances flexibility in their arrival times.
- (2) Eighty-nine percent stated a requirement for as much as one hour for patient evaluation.
- (3) Seventy-eight percent stated that patient records are usually not available until after the initial patient evaluation.
- (4) Sixty-seven percent responded that although the evaluation and scheduling of therapy are not usually delayed, cases where additional tests require immediate access to patient records disrupt the patient therapy cycle.
- (5) Fifty-five percent stated that lack of records and resultant disruptions in therapy occur fifty percent of the time or more.

- (6) Fifty-five percent stated that to minimize disruptions, records should be available before, at the time, or no more than one to two hours after the patient arrives for evaluation.

Based on the above answers, it is apparent that the requirement for immediate availability of the medical records, as part of an information processing system, is directly aligned with upper management's requirements.

c. Scheduling Department

The statistics for the scheduling department indicated the following:

- (1) Sixty-six percent responded with a requirement to have notice of patient arrival at the time the patient is admitted in order to initiate the scheduling cycle with minimal delays. This means that data on new admittances must be received in real time (at the time the events occur).
- (2) Sixty-six percent indicated a requirement to be able to set up a complete patient schedule in 15 to 30 minutes, in view of periods of excessive workloads.
- (3) Seventy-five percent responded that in order to organize and redistribute patient schedule changes to all involved parties, so as to allow normal continuation of patient care, knowledge was required of the changes either the day before or at the time they occurred. This requirement essentially means that schedule changes must be transmitted in "real time" as opposed to the existing time-frame of three to five days.
- (4) It was indicated that any scheduling system must provide a transfer of information to a minimum of six people.
- (5) The complete department indicated a requirement that 15 to 30 minutes be built into the scheduling system to allow patients to move from one therapy to the next.

d. Admitting and Diagnostics Departments

The admitting and diagnostics departments provided the following responses to their questionnaires:

- (1) In order to minimize patient wait time (and potential patient backlog) in the admitting process, the admitting department indicated a desire to process patients at the rate of one every 10 minutes, which indicates

that a very rapid information processing system must be used.

- (2) Diagnostics provided a requirement to have access, on demand, to doctors' schedules and information on the distance each patient travels, the means of patient transport, and the patient's schedule (if already established). Therefore, in addition to medical records, a scheduling information system must also contain all of the above-stated records.

e. Therapy and Clinical Departments

The statistics resulting from the therapy and clinical service department's responses revealed the following requirements pertaining to system response and scheduling procedures:

- (1) The complete department (with the exception of new employees) felt that 15 minutes was the maximum amount of time desired to perform the mechanics of scheduling a patient. Also, that in order to prevent disruptions in the patient care cycle, a one-day interval between admission and receipt of a confirmed schedule from the scheduling department was acceptable. These two areas were sources of confusion causing polarization of the answers. As stated earlier, this polarization was caused by a two-week lag between the time of explanation of the questions and the actual completion of the questionnaire. The original statistics are shown, along with the revised answers, in Appendix B.
- (2) As part of the scheduling procedures, over 90 percent of the group felt that more information on patient condition (both psychological and physiological) would be helpful in scheduling patients. This could be accomplished through a more complete patient pre-evaluation prior to admittance.
- (3) In determining flexibility for patients who are delayed between one therapy and the next, 72 percent indicated that no more than 15 minutes could elapse before their activity was ineffective as to patient improvement. This is important in that 77 percent felt that a 15-minute interval should be built into the scheduling system to allow patients to move from one therapy to the next.
- (4) In terms of administering therapy for set intervals of time, 91 percent felt that the amount of therapy a patient can endure varies with his condition. A general ranking of those disorders, from lowest to highest endurance, is as follows:

- (a) older stroke
- (b) closed head
- (c) neurologic
paraplegic
spinal cord
- (d) hand

Thirty-two percent of the participants provided the above response, and an additional 13 percent indicated that endurance was a function of psychological condition, as well.

- (5) Seventy-two percent of the directors indicated a requirement to be able to check therapists' schedules for patient workload redistribution (in the event of staff illness) and to reschedule workload in no more than one hour. Therefore, another important attribute for a new scheduling information system is to provide access to the therapists' schedules in real time.
- (6) Based on the response of 83 percent of the staff, the management of patient delays and schedule changes in terms of obtaining feedback and rescheduling must be done, respectively, within 15 minutes and no later than the time that the change occurs. Again, this supports the requirement to have the scheduling system operate in real time.
- (7) In addition to the above requirement, the expected number of schedule changes, delays, and no-shows that must be managed per therapist on a daily basis are:
 - (a) schedule changes: 1
 - (b) delays: 2
 - (c) no-shows: 1

As the hospital capacity increases, these numbers will probably increase; therefore, the scheduling system must allow simultaneous queries on patient schedules. Also, at the rate of one schedule change per therapist per day, the minimum number of schedule changes processed per day would be 66 (the number of therapists presently on the staff). With the expected growth of the Institute, this average number could increase. Therefore, in order to process 66 schedule changes per day, the actual scheduling procedures should be completed within seven minutes per patient. Again, the implication is that the scheduling procedure should be completed as closely as possible to real time.

f. Nursing

The results from the nursing questionnaire closely paralleled the responses from the therapist and clinical service department's responses.

- (1) Eighty percent of the directors indicated a requirement of completing the mechanics of the scheduling workload within 15 minutes, and of receiving a confirmed patient schedule within one day.
- (2) The question pertaining to the length of time required for workload redistribution, in the event of staff illness, received a unanimous response in favor of a maximum of 30 minutes.
- (3) As with the therapies, the patient condition and disability can potentially affect patients' meeting schedules. This was confirmed by 88 percent of the questionnaires. The general ranking of major disabilities by the amount of morning preparation time required was as follows:
 - (a) quadraplegics: no less than one hour and as much as 3.5 hours
 - (b) head injury: no less than 45 minutes and as much as 3.25 hours
 - (c) stroke: no less than 30 minutes and as much as 2.5 hours
 - (d) chronic pain/arthritis: no less than 15 minutes and as much as 2.5 to three hours
 - (e) paraplegics: no less than 15 minutes and as much as 1.25 hours

The range of answers provided was extremely germane to understanding that the amount of preparation time is a function of patient condition and that it increases as a patient becomes more self-sufficient. Therefore, a scheduling system should have a built-in compensation for both a patient's condition and progress. It is feasible that, although a patient's initial therapy may be delayed half a day, the 3.5 hours of preparation time in the morning may be equally important therapy. As additional support to this approach, 88 percent of the questionnaires indicated that some type of complete patient pre-evaluation would be helpful in knowing which patients would require priority in terms of morning preparation time.

- (4) Ninety-four percent stated a requirement to have knowledge of patient schedule changes at least one hour prior to a patient's first morning activity in order to allow sufficient preparation time. Again, as most schedule changes occur the previous day, the requirement is essentially that the scheduling system provide feedback to the nursing staff in real time.
- (5) As stated earlier, the floor clerks have a key role in transmitting revised physicians' orders and schedule changes to the nursing staff. On a daily basis, the floor clerks indicated handling an average of nine schedule changes at approximately 10.25 minutes per change. This activity consumes anywhere from ten to 19 percent of the clerks' total work day. The problem that potentially arises is that numerous other tasks infringe on their ability to manage reschedules. Therefore, a scheduling system must provide the floor clerks with real-time feedback on available time slots or rescheduled confirmations, in order to minimize the possibility that other tasks will prevent timely followup on schedule changes communicated to (or received from) the scheduling department.

g. Patients

The patient questionnaire provided interesting results in view of the sample population used. Approximately half of the sample were under 50 years of age (18 to 40), and the remaining half were in the range of 52 to 79. The results of the questions from both groups were as follows:

- (1) Ninety-two percent of the under-50 group indicated a requirement of at least 15 minutes to move between therapies. Fifty-seven percent of the over-50 group concurred with this requirement, and an additional 14 percent (patients considerably over 50) indicated that 15 to 30 minutes should be allowed to move between therapies.
- (2) In view of potential delays due to overlapping therapies, equipment breakdown, lack of assistance, and self-inflicted problems, the under-50 group appeared to experience a considerably higher incidence of delays than the over-50 group (71 percent versus 29 percent responded that the above-stated variables caused delays). Theoretically this is possible, because the Institute staff make an unconscious effort to assist the older patients.

The outstanding variables affecting schedules, as taken from the patient questionnaires, appeared to be those of equipment

availability and self-imposed delays. The over-50 group indicated a slightly greater problem with schedules' being physically taxing due to overexertion or to starting the day earlier than normal. In both the over- and under-50 age groups, however, only a small percentage (2. and 14 percent, respectively) indicated that they missed therapy for one of the above reasons. Therefore, it appears that, with the exception of certain disabilities and considerably older patients, the basic structure of the existing scheduling system appears to satisfy most patients.

3. Workload and Equipment Influence

The statistics for the workload and equipment variables generally indicated that they could be limiting factors in meeting established schedules.

a. Workload

The therapy and clinical service areas require time to perform other tasks, such as updating patient attendance sheets (for billing purposes) and reports, and attending meetings. The average time required to perform these tasks, in conjunction with meeting an average workload of 10 to 11 patients per day, indicates that the Institute may be at the limit of an acceptable balance between staff and workload. Therefore, in order to have time to perform more therapy, a scheduling information system should allow some of these peripheral tasks to be streamlined.

In the case of the nursing staff, it appeared that potential workload problems could arise if one nurse (or aide) were given the responsibility for several extremely difficult patients (i.e., quads, head injury, or older stroke patients). The reported comfortable workload per person was five patients.

The floor clerks reported approximately 17 tasks which they perform on a routine daily basis. Although transcribing doctors' orders and coordinating schedules are considered to be priority tasks, they appear to be performed on an equal basis with less important tasks. For example, the nursing staff does not necessarily request assistance under the condition "...only if you have no orders to transcribe or schedules to coordinate." Such situations can prevent floor clerks from coordinating schedule changes, as they occur, in a timely manner and could limit rapid response under any replacement scheduling system.

The variable of equipment availability was explored from two standpoints: nonavailability because of its being used by other individuals, and because of breakdown. Eighty-one percent of the participating therapists indicated that equipment was unavailable, at some time, due to its being utilized by other patients scheduled for the same area. Furthermore, 54 percent indicated that this happened at least half of the time.

Occupational therapy was not affected as severely as physical therapy, because alternate equipment could be used. As a result, even though patients arrive as scheduled, the possibility exists that equipment may not be available.

The patient responses to the problems associated with equipment indicated elevator nonavailability as a factor which limited their ability to meet schedules. It was anticipated that the results of the transportation department's questionnaire would provide additional insight into such equipment limitations; unfortunately, the response was minimal. It is strongly recommended that this questionnaire be completed at some time in the near future in view of the major role that transportation takes in insuring that patients arrive for therapy on schedule.

b. Equipment

Equipment breakdown was explored via questionnaires addressed to the equipment and building maintenance areas. The response of the building maintenance area was to the effect that the elevators were the only major equipment problems. Although it was reported that elevator failure was infrequent, the repair time was one to one-and-one-half hours. Even though therapies are segregated from patient floors, the fact that there are two patient elevators prevents the in-patient moving capacity from being completely reduced in the case of breakdown. However, the resulting queue at the operating elevator still prevents a major portion of the patients from reaching therapy areas as scheduled. The questionnaire indicated that a logistics support study had been done on the elevators. In reviewing this study, however, it appeared to be only a marginal study regarding the repair of the elevators at minimal cost. There was no mention of failure modes and effects, scheduled maintenance planning, spare parts support, or training of Institute personnel. Therefore, the question that must be asked is: How much is the Institute willing to spend to improve the equipment reliability and to decrease the repair time?

The equipment maintenance area provided data indicating five major pieces of equipment that contribute to outage: the ultrasound, diathermy, ECG, EMG, and defibrillator machines. As no logistics support plan exists for this equipment, failure data provided by the engineer indicated that an average of 56.25 therapy sessions per year have been lost due to equipment failure. Although this is not a sizeable number, the failures of the components were of an age-reliability type. Therefore, if the equipment is not replaced, the failure rate will increase as it gets older. Therefore, equipment failure can also act as a limiting factor in preventing patients from receiving therapy as scheduled.

IV. DELINEATION OF SYSTEM REQUIREMENTS

Based on the preceding discussion and the results of the questionnaires, the following system requirements for a scheduling information system were identified:

A. Scheduling System Functional Requirements

- (1) System capacity is 575 patient transactions daily.
- (2) Additional information capabilities:
 - (a) patient billing
 - (b) patient accounting
 - (c) medical records
 - (d) physician schedules
 - (e) therapist schedules
 - (f) patient schedules
 - (g) out-patient geographical location and distance from the Institute
 - (h) patient admitting data
 - (i) patient pre-evaluation data
- (3) Information availability must be "on demand."
- (4) Means of scheduling patients:
 - (a) Inputs for time-slots are provided by staff.
 - (b) System provides output in terms of positive confirmation or indication that time-slots are not available. (Schedules must be reproducible in soft copies.)
- (5) System response characteristics:
 - (a) Complete scheduling mechanics should be accomplished within seven minutes per patient.
 - (b) Feedback on delays, cancellations, and changes must be provided in real time (at the time the events occur). The system must provide some type of stimulus to alert all involved parties of the events as they occur.

- (c) The system must allow a minimum of six parties to be simultaneously apprised of changes in events.
- (d) Redistributing patient workload, in the event of staff illness, should take less than one hour.
- (e) The system must provide for simultaneous real-time queries on stored data from several persons. The average inquiry rate is:
 - . one schedule change per therapist
 - . two arrival delays per therapist
 - . one no-show per therapist

This means that satellite units must be available to allow queries and feedback to be entered by several people. The system response must be in real time.

B. Peripheral Requirements in Support of the Scheduling System

- (1) Establish a physiological and psychological patient pre-evaluation procedure. Enter into the information data bank, to assist in the schedule design, all pertinent information resulting from the evaluation, such as the possible effect of age on patient abilities, peculiar complications resulting from disability, psychological conditions, etc.
- (2) Program into the scheduling procedure an automatic 15-minute delay between therapies to allow for patient movement; consider allowing 15 to 30 minutes for elderly patients.
- (3) Consider programming the length of the therapy session as a function of patient disability to preclude the possibility of exceeding patient endurance.
- (4) Consider programming the morning preparation time in conjunction with the first morning session, as a function of patient disability and patient progress.

C. Potential System Constraints

1. Workload

- a. Potential imbalance between available transportation staff and patient-moving loads

- b. Possible imbalance between staff and patient workload, causing back-to-back scheduling and resultant delays in patient servicing

2. Equipment

- a. Equipment nonavailability due to simultaneous scheduling for the same area, causing schedule delays
- b. Equipment nonavailability, due to breakdown, preventing patients from reaching therapy or preventing therapy from being administered

3. Patient

Self-imposed delays which prevent schedules from being followed as planned

V. RECOMMENDATIONS

Prior to selecting a replacement scheduling system with the requirements established in the preceding sections, a number of other tasks should be completed.

Considering the growth of the hospital, a study should be designed to assist in determining possible constraints of space or equipment to handle projected capacity. Again, one can schedule patients, but if they cannot be serviced, an advanced scheduling system serves no purpose. The requirement related to additional information capabilities needs to be further defined. For example, the information should be formalized from the standpoint of the maximum number of appointments that physicians and therapists may have, the maximum number of therapy sessions that patients may have, or the presentation format of the individual schedules and medical records. This is key information needed to design the scheduling system.

Additionally, some type of methodology should be designed for evaluation of the merits of various scheduling systems. This methodology should allow proposed systems to be ranked by their ability to meet the requirements, cost, maintenance, backup capability in the event of breakdown, flexibility to handle different amounts of information, and many other attributes.

Finally, a "request for proposal" should be written to allow contractors to respond with appropriate designs. It is recommended that the Institute consider implementation of the above-stated tasks in the near future in view of its anticipated rapid growth.

In addition to the above work, the Institute may wish to consider defining some areas addressed in the preceding study in more detail. For example, relating patient disability to endurance and/or required preparation time requires closer study in view of the limited response received in these areas. Also, the possible development of a more detailed patient evaluation system is extremely difficult in terms of time and coordinating the evaluation team. The transportation variable also needs to be further defined. Finally, in view of trying to design an effective scheduling system, it may be worthwhile to pursue a logistics support effort to minimize the limiting effect of equipment non-availability.

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Appendix A

Complete Questionnaire

Questionnaire 1

Related Area - Upper Management

1. What is the expected growth of the Institute?
 - a. In-patient capacity
(in number of in-patients) _____
 - b. Total Out-patient capacity
(in number of out-patients) _____
 - c. Patient workload per day
In-patients _____
Out-patients _____
2. What is the expected rate of growth in terms of
 - a. In-patients per year? _____
 - b. Out-patients per year? _____
3. What additional services does the Institute wish to extract from an information processing system?
 - a. Billing services Yes _____ No _____
 - b. Patient accounting data Yes _____ No _____
 - c. Patient medical records Yes _____ No _____
4. Are there any plans to expand the Institute's people-moving facilities?
 - a. Put in extra elevators Yes _____ No _____
 - b. Convert stairs to ramps Yes _____ No _____
 - c. Take therapies to the patient as opposed to taking the patient to the therapies (i.e., establish satellite mini-centers on various floors that can handle an overflow of patients if elevators break down).

Yes _____ No _____
5. What volume of "in" and "out" patients would you like to be able to move from your patient floors to therapies at your peak hours of 9:00 a.m. and 1:00 p.m.? (Patient flow and que study recommended.)

Area _____

Questionnaire 2

Related Area - Physicians, Therapies and Clinical Services

Note to the Physicians, Directors and staff - This questionnaire is by no means a test or evaluation of an individual's capability or efficiency. Subsequently, the only information necessary is an indication of your respective area (physician, PT, OT, etc.) in the top righthand corner of the questionnaire. The information provided by the questionnaire will be used to determine requirements such as how much daily data must be processed by an information processing system, what types of data feedback are necessary, how quickly a system must respond for data feedback, and better define manning/patient capacity levels. It should be stated, that in establishing your requirements for desired patient service times, rates of information feedback, etc., it is necessary to be aware of ideal versus practical requirements. For example, in establishing requirements for equipment set-up time for a given therapy, it may be worthwhile to conduct task time studies to determine a reasonable requirement for equipment set-up (or calibration) to provide the desired patient service. Those questions where it is felt that a task time study would be beneficial in establishing requirements are noted.

Physician Related

1. From the time that a patient arrives and is admitted, what is the desirable wait time before a patient is evaluated? _____
2. What is your recommended time for patient evaluation?
 - a. Average case _____
 - b. Worst case _____
3. Are patient records available usually:
 - a. Before the patient is evaluated? _____
 - b. By the time the patient is evaluated? _____
 - c. After the evaluation? _____
4. If your answer to (3) above, was "c", is the evaluation and subsequent patient therapy scheduling delayed? Yes _____ No _____
5. If your answer to (4) above, was "yes", what is an acceptable delay period for the evaluation?

Questionnaire 2, cont'd.

6. In cases where the patient's physical state changes, or you wish to conduct additional tests, have you ever had to wait to receive the patient's records (and therefore delay any medical decision) a sufficient period of time to disrupt the patient therapy cycle?

Yes _____ No _____

7. Would you say this happens:

- a. Infrequently? _____
- b. About half the time? _____
- c. Frequently? _____

8. To minimize any disruption in the patient care cycle, what is your recommended wait time to receive patient records? _____

(Please consider your decision making time also in your answer.)

Area _____

Questionnaire 3

Related - Therapies and Clinical Services

Note to the Physicians, Directors and staff - This questionnaire is by no means a test or evaluation of an individual's capability or efficiency. Subsequently, the only information necessary is an indication of your respective area (physician, PT, OT, etc.) in the top righthand corner of the questionnaire. The information provided by the questionnaire will be used to determine requirements such as how much daily data must be processed by an information processing system, what types of data feedback are necessary, how quickly a system must respond for data feedback, and better define manning/patient capacity levels. It should be stated, that in establishing your requirements for desired patient service times, rates of information feedback, etc., it is necessary to be aware of ideal versus practical requirements. For example, in establishing requirements for equipment set-up time for a given therapy, it may be worthwhile to conduct task time studies to determine a reasonable requirement for equipment set-up (or calibration) to provide the desired patient service. Those questions where it is felt that a task time study would be beneficial in establishing requirements are noted.

Questionnaire 3, cont'd.

Therapies/Clinically Related

1. From the time that a patient is admitted and evaluated what would you recommend as an acceptable wait time before you receive formal notice to schedule a given patient for your activity? _____
2. What would you recommend as an acceptable amount of time to actually go through the mechanics of scheduling a patient(s)? _____
(Consider periods of excessive workload, and determine what time you would have ideally preferred spending to handle the workload.)
3. From the time of admission, what would you recommend as an acceptable period of time to receive an official, confirmed patient schedule from the hospital scheduling system? _____
(Consider when you would like to start the patient care cycle.)
4. To assist the scheduling process, would you recommend that a means of prioritizing therapy and clinical care, based on patient condition, be established? Yes _____ No _____
5. If your answer to (4) above, was "yes", do you think some system of patient pre-evaluation (evaluation before the patient is actually admitted or scheduled for activities) would be helpful? Yes _____ No _____
6. At the time the patient is scheduled to arrive, as compared to the time when the patient actually arrives, how much time can elapse before you consider your activity ineffective in terms of affecting patient improvement? _____
(This question assumes that the patient's activity schedule will not allow any delays in getting to the next activity.)
7. How much time would you recommend necessary to set up required equipment for patient therapy? (Time study recommended.)
 - a. Old equipment _____
 - b. Newer equipment _____

(If your activity does not necessarily require use of equipment, then simply indicate "not applicable".)

Questionnaire 3, cont'd.

8. From the time the patient is set up for your activity, what would you recommend as the proper amount of time required for your activity to be beneficial to the patient, but not exceed the patients physical endurance? _____
- a. Would you say that this time varies according to the type of patient you are working with?
Yes _____ No _____
- b. If so, indicate where possible the general group of patients affected (i.e., for example, older stroke patients as one group, or younger spinal injury patients as another group).

9. (For the director of each activity.) From the time that you receive notice that a member of your staff is ill and will not attend work, what would you recommend as an acceptable time necessary to redistribute the patient workload so that all patients receive your service as scheduled? _____
10. Given that there is a delay in a patient arriving at your activity, what would you recommend as an acceptable time to get feedback as to why the delay has occurred so that you may still have time to locate the patient, and still meet your activity requirements? _____
11. Given that there is a schedule change in a patient's given routine, when must you learn of the change in order for you to reschedule the patient for another time the same day, or schedule another "in" or "out" patient for the same time slot?
- a. Preferably more than one day in advance? _____
- b. At least one day in advance? _____
- c. Preferably, at the time that it happens? _____
- d. The same day? _____
- (You may select more than one answer - simply indicate which of the answers is the absolute limit effecting successful performance of your function.)
12. How much time would you recommend be allocated for patients to move from one therapy activity to the next? _____

Questionnaire 3, cont'd.

13. What would you recommend as to the amount of time (on a per day basis) you require for:
- a. Updating patient attendance sheets? _____
 - b. Filling out reports? _____
 - c. Meetings? _____
14. In the use of various equipment for various therapies, have you ever experienced a situation where equipment was unavailable because of other patients being scheduled for the same area at the same time? Yes _____ No _____
15. If your answer to (14) above was "yes", would you say that this happens:
- a. Infrequently? _____
 - b. Half of the time? _____
 - c. Frequently? _____
- (Recommended area and time study to observe que build-up.)
16. What would you say is the maximum allowable waiting time for having access to the equipment before your patient activity is no longer beneficial to the patient? _____
17. What is the number of patients you feel you can comfortably provide maximum service to on a daily basis? _____
18. How many patient schedule changes, arrival delays, or no-shows do you observe on a daily basis? _____

Job Classification _____

Questionnaire 4

Related Area - Directors, Nursing Staff, Aids, and Floor Clerks

Note to the Directors and Staff: This questionnaire is by no means a test or evaluation of an individual's capability or efficiency. Subsequently, the only information necessary is an indication of your respective area (director, nurse, nursing aid, or floor clerk) in the top righthand corner of the questionnaire. The information provided by the questionnaire will be used to determine requirements such as how much daily data must be processed by an information processing system, what types of data feedback are necessary, how quickly a system must respond for data feedback, and better define manning/patient capacity levels.

Director Related:

1. From the time that a patient arrives on the nursing floor, what would you recommend as an acceptable wait time before you receive formal notice to schedule your nursing workload?

(Consider when you would like to start the patient care cycle.)

2. What would you recommend as an acceptable amount of time to actually go through the mechanics of scheduling workload for all patients?_____

(Consider how much time this process takes during high workload periods and determine how much you would like to improve this present time.)

3. What would you recommend as an acceptable period of time to receive an official confirmed patient schedule back from the scheduling department?_____

6. From the time that you receive notice that a member of your staff is ill and will not attend work, what would you recommend as the necessary time required to redistribute the patient workload so that all patients receive your service as scheduled?_____

Questionnaire 4, cont'd.

Directors/Nursing Staff/Nursing Aid Related: RN, LPN, Assistant

1. From the time that a patient is awakened in the morning, in terms of getting a patient ready for the first activity of the day, do you think that this is a function of patient condition?
Yes _____ No _____

- a. List the disability of patients (i.e., quadriplegics, head injury, stroke, etc.) in order of difficulty in terms of the amount of preparation time required. _____

(Recommend time study.)

- b. Indicate the amount of preparation time you recommend for each group. _____

(Recommend time study.)

Disability

Time (recommended)

1.

2.

3.

4.

5.

2. To assist the workload scheduling process, would you recommend that a means of prioritizing your workload, based on patient goals, be established? Yes _____ No _____
3. If your answer to (3) above was "yes", do you think some system of patient pre-evaluation (evaluation before the patient is actually admitted and scheduled for activities) would be helpful? Yes _____ No _____
4. If your answer to (4) above was "no", would having early access to patient medical records serve the same purpose? Yes _____ No _____
5. If your answer to (5) above was also "no", what would you suggest?

Questionnaire 4, cont'd.

6. How much time would you recommend necessary to set up required equipment for patient preparation in the morning? (Time study recommended.)
- a. Indicate type of equipment and associated time on reverse side of sheet.
- (1) Nursing Care Equipment & Time Recommended
- (2) Assistive Device Equipment & Time Recommended
- b. Does this preparation time vary according to patient condition? Yes _____ No _____
- c. Indicate which groups this refers to (i.e., older stroke patient, head injury, etc.).
7. Are there differences between "old" and "new" equipment, beds, suction machines, lifts, etc., that may affect your recommendations in question (6)? Yes _____ No _____
- a. Indicate below which of the equipment, listed in (6) above, fit into this category.
8. What is the maximum number of patients you recommend persons with your classification be responsible for? _____
9. Given that there is a change in the patient schedule, when must you learn of the change in order to ensure patient delivery at the proper time to a given activity?
- a. Preferably at the time that it happens? _____
- b. At least one day in advance? _____
- c. By the time the morning nursing shift arrives? _____
- d. One hour before the patient must attend the first morning activity? _____
- e. One-half hour before the patient must attend the first morning activity? _____

(In answering, consider what time is required so that you have sufficient time to satisfactorily perform preparation tasks - also, indicate which of the answers is your absolute limit in terms of being able to satisfactorily perform your task.)

Questionnaire 4, cont'd.

Floor Clerk Related:

1. In terms of your responsibility, list below your major tasks in order of importance and what percentage of your working day you spend performing these tasks.

2. Do you feel time you spend performing your tasks is in line with the above priorities? Yes _____ No _____

3. In terms of performing the task of coordinating and communicating schedule changes, how much time do you feel you require (on a daily basis) to do this job effectively? _____
(Consider how much time your other tasks detract from your being able to receive or transmit schedule changes in a timely manner.)

(Recommend time study.)

4. How many schedule changes per day, on the average, do you have to coordinate? _____

5. How much average time does each schedule change take to coordinate? _____

6. At what times in the day is the rescheduling workload the most demanding of your time? _____

7. How many people (on the average) are involved with each schedule change? _____

Questionnaire 5

Related Area - Equipment and Building Maintenance

1. In terms of various potentially high failure rate equipment (elevators, ultrasound, diathermy, stimulators, etc.) does failure and subsequent repair time cause delays in service or the movement of patients from one activity to the next:
 - a. Infrequently? _____
 - b. Half the time? _____
 - c. Frequently? _____
 - d. At random intervals? _____
 - e. At relatively regular intervals? _____
2. List below (from worst to best) the critical equipment affecting patient service and movement.
3. For the critical equipment listed in (2) above, in terms of equipment availability, indicate the amount of time required to repair the equipment (or find a replacement) and also the time it is allowed to be out of service before affecting patient service or movement. (Recommend time study.)
4. Has any type of logistics support study of the above major components ever been conducted? (This study includes examining stocking of spare parts, spare components, proper training of the users to preclude equipment abuse, determination of preventive maintenance scheduling, etc.)
Yes _____ No _____

Questionnaire 6

Related Area - Scheduling Department

1. From the time that a patient is admitted, what would you recommend as the amount of time you require (in order to start the scheduling cycle) to receive notice of the patient arrival?
 - a. Before the patient is admitted? _____
 - b. Preferably at the time the patient is admitted? _____
 - c. On the day the patient is admitted? _____
2. On the average, how much time would you recommend necessary to go through the mechanics of setting up and initiating (the paperwork) a patient schedule? _____
(Consider when your workload is excessive, and determine how much time you would need to perform this task to return you to a normal workload.)
3. What is the maximum number of patients you feel you could schedule (both "in" and "out" patients) per day if you could schedule each patient within the time you recommended in (2) above?

4. Given that a patient's schedule is changed, when must you learn of the change in order for you to inform all related therapy areas such that another patient could be schedule for the same time slot, reschedule other affected patients, and allow normal continuation of patient care? _____
 - a. Preferably at the time the change happens? _____
 - b. The day before the change occurs? _____
 - c. Sometime during the day that the change occurs? _____

(You can choose more than one answer, simply indicate which of the answers is the absolute limit effecting successful performance of your function.)
5. How many parties (on the average) are involved with each schedule change? _____
6. How much time would you recommend be allocated for patients to move from one therapy activity to the next? _____

Area _____

Questionnaire 7 - To be conducted by Volunteer Services

Related Area - Patients (spinal injury and stroke)

Indicate patient category in top righthand corner of questionnaire.

1. Are there certain types of equipment that cause problems in your morning preparation, or delays in getting to your therapies? Yes _____ No _____
 - a. That delays were a function of lack of people to assist in your movement? Yes _____ No _____
 - b. That delays were due to yourself? Yes _____ No _____
2. List below the equipment referred to in (1) above.
3. In your movement from one therapy to the next, how much time (on the average) does it take you to get to your next therapy activity? _____
 - a. Would you say that most of your delays, when they occurred, were a function of overlaps in therapies? Yes _____ No _____
 - b. That delays were a function of equipment? Yes _____ No _____
 - c. That delays were a function of lack of people to assist in your movement? Yes _____ No _____
 - d. That delays were due to yourself: Yes _____ No _____
4. In terms of the therapy schedule you were assigned to when you first came to the Institute, have you ever felt that the schedule was too exhausting?
 - a. Because it exceeded your endurance? Yes _____ No _____
 - b. Because it required you to start the day much earlier than you normally did in the past? Yes _____ No _____
5. Have you ever not attended therapy for one of the above reasons? Yes _____ No _____
6. In view of (4) and (5) above, would you prefer certain therapies first over others? Yes _____ No _____
 - a. How would you prioritize the therapies?

Questionnaire 8

Related Area - Admitting and Diagnostics

Admitting Related:

1. From the time that a patient arrives, how much time would you recommend to go through the process of admitting (patient forms, etc.) so as to minimize the wait of other patients waiting to be admitted? _____

(Consider patient backlog at your worst workload periods and determine what time would have minimized that backlog.)

Diagnostics Related:

1. In terms of matching the doctor's schedules with patient appointments, which of the following information would be helpful?
 - a. Access to doctor's schedules? Yes _____ No _____
 - b. Distance patient travels? Yes _____ No _____
 - c. Means of patient transport? Yes _____ No _____
 - d. Patient schedule
(if treatment already started)? Yes _____ No _____
2. What is your recommended time to assemble and record, or have access to and extract, the above information?
 - a. On demand? Yes _____ No _____
 - b. Within fifteen minutes after the patient arrives?
Yes _____ No _____
 - c. Within one hour after the patient arrives?
Yes _____ No _____

Questionnaire 9

Related Area - Transportation

1. What is the average volume of "in" and "out" patients moved from:
 - a. Floor to floor at each half hour increment, starting at 9:00 a.m.?
(Recommend patient flow study.)
 - b. The Rehabilitation Institute to Harper and return (on an hourly basis)?
(Recommend patient flow study.)
2. What is the average number of patients one transporter can move from the elevator to a given therapy without causing patients to be tardy for their respective activities? _____
(Recommend time study at both low and peak periods.)
3. In terms of schedule availability for workload planning purposes, are both "in" and "out" patient schedules available?
Yes _____ No _____
 - a. Which is available? _____
4. List the other jobs that are required of you during a normal workday, how often you do them, and how much time is required to perform these jobs?
5. Does equipment you use for transporting patients affect your ability to get them to their respective destinations on time?
Yes _____ No _____
 - a. If so, list the equipment below and indicate the number of times per day (or per week) the equipment is not functional or is unavailable; and the average amount of time the equipment is not available for service.

Appendix B

Detail Statistical Tabulation of Questionnaire Responses

I. Questions Related to Scheduling Information System Requirements

A. Related Questionnaire Area - Upper Management

Total Population 4 Number responses 2

1. What is the expected growth of the Institute?

a. In-patient capacity
(in number of in-patients) 160

b. Total out-patient capacity
(in number of out-patients) 400

c. Patient workload per day
In-patients 160
Out-patients 400

2. What is the expected rate of growth in terms of

a. In-patients per year? 10

b. Out-patients per year? --

3. What additional services does the Institute wish to extract from an information processing system?

a. Billing services Yes ✓ No

b. Patient accounting data Yes ✓ No

c. Patient medical records Yes ✓ No

4. Are there any plans to expand the Institute's people-moving facilities?

a. Put in extra elevators. Yes No ✓

b. Convert stairs to ramps Yes No ✓

c. Take therapies to the patient as opposed to taking the patient to the therapies (i.e., establish satellite mini-centers on various floors that can handle an overflow of patients if elevators break down).
Yes ✓ No

5. What volume of "in" and "out" patients would you like to be able to move from your patient floors to therapies at your peak hours of 9:00 a.m. and 1:00 p.m.? (Patient flow and que study recommended.)

I. Scheduling Information System Requirements (cont'd)

B. Related Questionnaire Area - Physician

Total people 14 Number of responses 9

1. From the time that a patient arrives and is admitted, what is the desirable wait time before a patient is evaluated?
.33 (45-60), .22 (0-15), .11 (30-45), .11 (2 hr), .11 (8 hr), .11 (1 day)
2. What is your recommended time for patient evaluation?
 - a. Average case .56 (45-60), .22 (15-30), .11 (30-45), .11 (1.5 hr)
 - b. Worst case .44 (1.5 hr), .33 (2 hr), .22 (1 hr)
3. Are patient records available usually:
 - a. Before the patient is evaluated? 0
 - b. By the time the patient is evaluated? .22
 - c. After the evaluation? .78
4. If your answer to (3) above, was "c", is the evaluation and subsequent patient therapy scheduling delayed?
Yes .22 No .78
5. If your answer to (4) above, was "yes", what is an acceptable delay period for the evaluation?
1 - (1 day), 1 - (2 days)
6. In cases where the patient's physical state changes, or you wish to conduct additional tests, have you ever had to wait to receive the patient's records (and therefore delay any medical decision) a sufficient period of time to disrupt the patient therapy cycle? Yes .67 No .33
7. Would you say this happens:
 - a. Infrequently? .44
 - b. About half the time? .44
 - c. Frequently? .11

I. Scheduling Information System Requirements (cont'd)

8. To minimize any disruption in the patient care cycle, what is your recommended wait time to receive patient records?

(Please consider your decision making time also in your answer.)

- .33 (before or at time patient arrives)
- .22 (1-2 hr)
- .11 (8 hr)
- .22 (1 wk)
- .11 (no answer)

C. Related Questionnaire Area - Scheduling Department

Total population 4 Number of responses 3

1. From the time that a patient is admitted, what would you recommend as the amount of time you require (in order to start the scheduling cycle) to receive notice of the patient arrival?
 - a. Before the patient is admitted? 0
 - b. Preferably at the time the patient is admitted? .66
 - c. On the day the patient is admitted? .33
2. On the average, how much time would you recommend necessary to go through the mechanics of setting up and initiating (the paperwork) a patient schedule? .66 (15-30 min),
.33 (45-60 min)

(Consider when your workload is excessive, and determine how much time you would need to perform this task to return you to a normal workload).
3. What is the maximum number of patients you feel you could schedule (both "in" and "out" patients) per day if you could schedule each patient within the time you recommended in (2) above? -, 16, 8 (avg = 12)
4. Given that a patient's schedule is changed, when must you learn of the change in order for you to inform all related therapy areas such that another patient could be scheduled for the same time slot, reschedule other affected patients, and allow normal continuation of patient care?
 - a. Preferably at the time the change happens? .25
 - b. The day before the change occurs? .50

I. Scheduling Information System Requirements (cont'd)

c. Sometime during the day that the change occurs?

.25 (early morning)

(You can choose more than one answer, simply indicate which of the answers is the absolute limit effecting successful performance of your function.)

5. How many parties (on the average) are involved with each schedule change? 6, 8, 3 (avg = 6)

6. How much time would you recommend be allocated for patients to move from one therapy activity to the next?
.66 (15 min), .33 (15-30 min)

D. Related Questionnaire Area - Admitting

Total people 1 Number of responses 1

1. From the time that a patient arrives, how much time would you recommend to go through the process of admitting (patient forms, etc.) so as to minimize the wait of other patients waiting to be admitted? 10 min

(Consider patient backlog at your worst workload periods and determine what time would have minimized that backlog.)

E. Related Questionnaire Area - Diagnostics

Total population 2 Number of responses 2

1. In terms of matching the doctor's schedules with patient appointments, which of the following information would be helpful?

a. Access to doctor's schedules? Yes ✓ No

b. Distance patient travels? Yes ✓ No

c. Means of patient transport? Yes ✓ No

d. Patient schedule
(if treatment already started)? Yes ✓ No

2. What is your recommended time to assemble and record, or have access to and extract, the above information?

a. On demand? Yes ✓ No

b. Within fifteen minutes after the patient arrives?
Yes No

c. Within one hour after the patient arrives? Yes No

I. Scheduling Information System Requirements (cont'd)

F. Related Questionnaire Area - All Therapies and Clinics

Total population 66 Number of responses 43

1. From the time that a patient is admitted and evaluated what would you recommend as an acceptable wait time before you receive formal notice to schedule a given patient for your activity? .53 (1 day), .26 (2 days), 0.2 (1.5 days), .02 (3 days), .02 (6.5 hr), .05 (4 hr), .05 (2 hr), .09 (0-15 min)
2. What would you recommend as an acceptable amount of time to actually go through the mechanics of scheduling a patient(s)? .27 (15 min), .09 (15-30 min), .02 (45-60 min), .05 (3.5 hr), .02 (4 hr), .23 (1 day), .16 (2 days), .05 (3 days), .02 (7 days), .07 (no answer)
(Consider periods of excessive workload, and determine what time you would have ideally preferred spending to handle the workload.)
3. From the time of admission, what would you recommend as an acceptable period of time to receive an official, confirmed patient schedule from the hospital scheduling system? .33 (1 day), .19 (2 days), .21 (3 days), .07 (1.5 day), .02 (4 days), .05 (1 wk), .02 (4 hr), .02 (1 hr), .05 (15 min), .04 (no answer)
(Consider when you would like to start the patient care cycle).
4. To assist the scheduling process, would you recommend that a means of prioritizing therapy and clinical care, based on patient condition, be established? Yes .93 No .07
5. If your answer to (4) above, was "yes", do you think some system of patient pre-evaluation (evaluation before the patient is actually admitted or scheduled for activities) would be helpful? Yes .91 No .09
6. At the time the patient is schedule to arrive, as compared to the time when the patient actually arrives, how much time can elapse before you consider your activity ineffective in terms of affecting patient improvement? .72 (0-15 min), .05 (15-30 min), .20 (no answer)
(This question assumes that the patient's activity schedule will not allow any delays in getting to the next activity.)

Note: Questions 2 and 3 above were re-examined on the final return trip to the Institute in view of the polarization in answers. The complete group met and they were queried as to how they interpreted the questions. A large number were not clear as to whether

I. Scheduling Information System Requirements (cont'd)

the questionnaire was addressing the way the system works now, or, in considering recommendations, what would be reasonable improvements. The questions and extreme circumstances were explained again resulting in the following responses -

Question 2 - All felt 15 min was acceptable

Question 3 - All felt 1 day was acceptable

7. From the time the patient is set up for your activity, what would you recommend as the proper amount of time required for your activity to be beneficial to the patient, but not exceed the patients physical endurance? .35 (15-30 min),
.33 (30-45 min), .09 (15 min), .02 (45-60 min),
.18 (no answer)

- a. Would you say that this time varies according to the type of patient you are working with?

Yes .91 No 0 .09 (no answer)

- b. If so, indicate where possible the general group of patients affected (i.e., for example, older stroke patients as one group, or younger spinal injury patients as another group.

General ranking of disorders by amount of time patients can endure therapy (ranked least to most) -

	<u>Disorders</u>	<u>Magnitude of responses</u>
About same in ranking	Older stroke Closed head Neurologic Paraplegics Spinal cord Hand	.32
	Depending on physical/psychological condition	.13
	No answer	.55

8. (For director of each activity.) From the time that you receive notice that a member of your staff is ill and will not attend work, what would you recommend as an acceptable time necessary to redistribute the patient workload so that all patients receive your service as scheduled?
(18 responses), .28 (45-60 min), .22 (15-30 min),
.11 (15 min), .11 (30-45 min), .06 (1.5 hr), .11 (3 hr),
.03 (1 day) .08 (no answer)

I. Scheduling Information System Requirements (cont'd)

9. Given that there is a delay in a patient arriving at your activity, what would you recommend as an acceptable time to get feedback as to why the delay has occurred so that you may still have time to locate the patient, and still meet your activity requirements? .86 (0-15 min, most 5-10 min), .09 (no answer), .02 (15-30 min)
10. Given that there is a schedule change in a patient's given routine, when must you learn of the change in order for you to reschedule the patient for another time the same day, or schedule another "in" or "out" patient for the same time slot?
- a. Preferably more than one day in advance? .26
- b. At least one day in advance? .44
- c. Preferably, at the time that it happens? .13
- d. The same day? .16
- (You may select more than one answer - simply indicate which of the answers is the absolute limit effecting successful performance of your function.)
11. How much time would you recommend be allocated for patients to move from one therapy activity to the next?
.77 (15 min), .16 (15-30 min), .07 (no answer)
12. How many patient schedule changes, arrival delays, or no-shows do you observe on a daily basis?
SC avg/therapist/day - 1 (high - 3, low - 0),
AD avg/therapist/day - 2 (high 10, low 0),
DNS avg/therapist/day - 1 (high 7, low 0)

G. Related Questionnaire Area - Director of Nursing

Total day population 5 Number of responses 5

1. From the time that a patient arrives on the nursing floor, what would you recommend as an acceptable wait time before you receive formal notice to schedule your nursing workload? .80 (day before), .20 (same day)
2. What would you recommend as an acceptable amount of time to actually go through the mechanics of scheduling workload for all patients? .20 (15 min), .80 (15-30 min)
(Consider how much time this process takes during high workload periods and determine how much you would like to improve this present time.)

I. Scheduling Information System Requirements (cont'd)

3. What would you recommend as an acceptable period of time to receive an official confirmed patient schedule back from the scheduling department? .80 (1 day), .2 (2 days)
4. From the time that you receive notice that a member of your staff is ill and will not attend work, what would you recommend as the necessary time required to redistribute the patient workload so that all patients receive your service as scheduled? .80 (15 min), .20 (15-30 min)

H. Related Questionnaire Area - Nursing

Total day population Unk Number of responses 16

1. From the time that a patient is awakened in the morning, in terms of getting a patient ready for the first activity of the day, do you think that this is a function of patient condition? Yes .88 No 0 .12 (no answer)

- a. List the disability of patients (i.e., quadriplegics, head injury, stroke, etc.) in order of difficulty in terms of the amount of preparation time required.

See below

(Recommend time study.)

- b. Indicate the amount of preparation time you recommend for each group. See note below.
(Recommend time study.)

<u>Disability</u>	<u>Time</u> (recommended)
1. Quads	.50 (45-60 min), .12 (1.25 hr), .13 (3.25 hr), .06 (2.5 hr), .06 (3.5 hr), .06 (30-45 min), .06 (no answer)
2. Head injury	.56 (45-60 min), .13 (3.5 hr), .06 (3.25 hr), .12 (no answer)
3. Stroke	.31 (30-45 min), .13 (45-60 min), .13 (15-30 min), .13 (2.5 hr), .06 (2.25 hr), .24 (no answer)
4. Chronic pains/ arthritic	.19 (2.5-3 hr), .12 (30-45 min), .13 (15-30 min), .55 (no answer)
5. Para	.25 (1.25 hr), .06 (45-60 min), .13 (30-45 min), .38 (15-30 min), .18 (no answer)

I. Scheduling Information System Requirements (cont'd)

	<u>Disability</u>	<u>Time</u> (recommended)
6.	MS	.06 (45-60 min), .94 (no answer)
7.	Amputee	.06 (30-45 min), .06 (15-30 min), .88 (no answer)

Note: Based on answers to 1.b above, the required prep time for therapy schedules could be affected by distribution of patients to staff, by disability.

2. To assist the workload scheduling process, would you recommend that a means of prioritizing your workload, based on patient goals, be established?

Yes .63 No .33 .04 (no answer)

3. If your answer to (3) above was "yes", do you think some system of patient pre-evaluation (evaluation before the patient is actually admitted and scheduled for activities) would be helpful? Yes .88 No 0 .12 (no answer)

4. If your answer to (4) above was "no", would having early access to patient medical records serve the same purpose? Yes .06 No .63 .31 (no answer)

5. If your answer to (5) above was also "no", what would you suggest? No response

6. Given that there is a change in the patient schedule, when must you learn of the change in order to ensure patient delivery at the proper time to a given activity?

a. Preferably at the time that it happens? 0

b. At least one day in advance? .50

c. By the time the morning nursing shift arrives? .25

d. One hour before the patient must attend the first morning activity? .19

e. One-half hour before the patient must attend the first morning activity? .06

(In answering, consider what time is required so that you have sufficient time to satisfactorily perform your tasks - also, indicate which of the answers is your absolute limit in terms of still being able to satisfactorily perform your task.)

I. Related Questionnaire Area - Floor Clerks

1. In terms of performing the task of coordinating and communicating schedule changes, how much time do you feel you require (on a daily basis) to do this job effectively?
 .50 (15-30 min), .25 (10-15 min), .25 (5 min)

2. How many schedule changes per day, on the average, do you have to coordinate? Avg/day - 9

4. At what times in the day is the rescheduling workload the most demanding of your time? .80 (9 AM-11:30 AM),
.20 (no answer)

J. Related Questionnaire Area - Patients

1. In your movement from one therapy to the next, how much time (on the average) does it take you to get to your next therapy activity? <50 (.92 (5-15 min)), .08 (no answer), >50 (.57 (5-15 min)), .14 (15-30 min), .23 (no answer))

b. That delays were a function of equipment?

Yes	<50-.71,	No	<50-.21	.08	(no answer)
	>50-.29		>50-.38	.33	(no answer)

c. That delays were a function of lack of people to assist in your movement? Yes <50-.36, >50-.19
No <50-.57, >50-.52 07 (no answer), .29 (no answer)

B-11

I. Scheduling Information System Requirements (cont'd)

2. In terms of the therapy schedule you were assigned to when you first came to the Institute, have you ever felt that the schedule was too exhausting?

a. Because it exceeded your endurance?

Yes	<u><50-.36,</u>	No	<u><50-.64</u>	
	<u>>50-.38</u>		<u>>50-.57</u>	.05 (no answer)

b. Because it required you to start the day much earlier than you normally did in the past?

Yes	<u><30-.21,</u>	No	<u><50-.71</u>	.08 (no answer)
	<u>>50-.28</u>		<u>>50-.38</u>	.34 (no answer)

3. Have you ever not attended therapy for one of the above reasons? Yes <50-.21, No <50-.79,

<u>>50-.14</u>	<u>>50-.71</u>	.15 (no answer)
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4. In view of (4) and (5) above, would you prefer certain therapies first over others?

Yes	<u><50-.29</u>	No	<u><50-.71</u>	
	<u>>50-.29</u>		<u>>50-.57</u>	.14 (no answer)

a. How would you prioritize the therapies?

<u><50</u>	<u>>50</u>
(.21 response)	(.29 response)
PT (PT3 PT2)	PT (PT3 first)
ADL	OT
OT	ADL

Note - There appears to be no major delineation of delays between the two age groups except in the amount of time required to move from one therapy to the next.

II. Questions Related to Workload Limitations Affecting Scheduling

A. Related Questionnaire Area - All Therapies and Clinics

Total population 66 Number of responses 43

1. What would you recommend as to the amount of time (on a per day basis) you require for:

a. Updating patient attendance sheets: Avg 17 min
(high 30, low 5)

b. Filling out reports? Avg 63 min (high 120, low 10)

c. Meetings? Avg 64.5 min (high 180, low 20)

Calculation of actual available therapy time -

Non-therapy time

<u>Activity</u>	<u>Times (min)</u>
a. Updating patient attendance sheets	17
b. Filling out reports	63
c. Meetings	64
d. Lunch break	60
Total	204.5
Total (hrs/day)	3.4

Based on 8 hr work day -

$8 - 3.4 = 4.6$ hrs of therapy actually available
(this does not consider time lost for delays and no-shows)

Note - In view of reported comfortable workload of 10 patients/day/therapist which is present approximate workload), it appears that the Institute is presently at the limit, or just below the limit, of an acceptable workload/staff balance. Therefore, with expected growth of Institute starting approximately in 1980, a workload problem is imminent, and it appears that this could affect the scheduling of patients.

2. What is the number of patients you feel you can comfortably provide maximum service to on a daily basis?

PT, OT, ADL - Avg 10 SS - avg 3-4

II. Workload Limitations Affecting Scheduling (cont'd)

B. Related Questionnaire Area - Nurses

Total day population Unk Number of responses 16

1. What is the maximum number of patients you recommend persons with your classification responsible for?
Avg 5 (high 16, low 2-3)

C. Related Questionnaire Area - Floor Clerks

Total day population 6 Number of responses 6

1. In terms of your responsibility, list below your major tasks in order of importance and what percentage of your working day you spend performing these tasks.

Floor Clerk Time Study - based on 6 responses to time study
(2 days/person tabulated)

Existing Tasks and Time Allocation (%/day)

1. Typing/transcribing and passing doctor's orders .37
2. Patient scheduling tasks .10-.19
 - a. Coordinating patient appointments for other tests/travel slips
 - b. Cancelling therapy appointments
 - c. Calling to check on therapy schedule revisions with scheduling department.
 - d. Checking on patient delays.
3. Answering phone .10
 - a. Personal messages
 - b. Business related
4. Filing orders/updating files/sorting mail .10
5. Miscellaneous .14-.23
 - a. Calling in consults
 - b. Taking drug prescriptions
 - c. Answering patient call lights and assisting nursing staff

II. Workload Limitations Affecting Scheduling (cont'd)

d. Ordering supplies

e. Informing housekeeping of linen requirements and room cleaning

f. Chart checking

Total

1.00

2. Do you feel time you spend performing your tasks is in line with the above priorities?

Yes .80 No 0 .20 (no answer)

III. Questions Related to Equipment Limitations Affecting Scheduling

A. Related Questionnaire Area - All Therapies and Clinics

Total population 66. Number of responses 43.

1. How much time would you recommend necessary to setup required equipment for patient therapy? (Time study recommended)

a. Old equipment .51 (5-15 min), .02 (15-30 min),
46 (no answer)

b. Newer equipment .53 (5-15 min), .46 (no answer)

(If your activity does not necessarily require use of equipment, then simply indicate "not applicable".)

(No major difference between equipment set-up times observed.)

2. In the use of various equipment for various therapies, have you ever experienced a situation where equipment was unavailable because of other patients being scheduled for the same area at the same time?

Yes .81 No .02, .14 (no answer)

3. If your answer to (2) above was "yes", would you say that this happens:

a. Infrequently? .33

b. Half of the time? .40 (.20 PT, .20 OT (but can use other equipment))

c. Frequently? .14 (PT-on a department basis)
.14 (no answer)

(Recommended area and time study to observe que build-up).
(See below)

4. What would you say is the maximum allowable waiting time for having access to the equipment before your patient activity is no longer beneficial to the patient?
.53 (within 15 min), .46 (no answer)

Based on 3 above, it appears that equipment availability could effect ability to provide therapy to patient at the scheduled time.

III. Equipment Limitations Affecting Scheduling (cont'd)

B. Related Questionnaire Area - Nurses

Nursing (RN's, LPN's, Asst's)

Total Day Population Unk. Number of responses 16.

1. How much time would you recommend necessary to setup required equipment for patient preparation in the morning? (Time study recommended).

- a. Indicate type of equipment and associated time below.

.38 (15-30 min - hygiene equipment)
.06 (0-15 min - no equipment delineated)
.06 (45-60 min - no equipment delineated)
.06 (15 min - slings/safety belts)
.06 (15 min - feeding)
.06 (wheel chain adjustment)
.32 (no answer)

- b. Does this preparation time vary according to patient condition? Yes .88 No .06 .06 (no answer)

- c. Indicate which groups this refers to (i.e., older stroke patient, head injury, etc.) .56 (Quad, head, stroke), .44 (no answer)

2. Are there differences between "old" and "new" equipment beds, suction machines, lifts, etc. that may effect your recommendations in question (1)?

Yes .88 No 0 .12 (no answer)

- a. Indicate below which of the equipment, listed in (1) above, fit into this category. Beds, lifts, suction machines (these answers do not allow any conclusions to be drawn).

C. Related Questionnaire Area - Patients (spinal injury and stroke)

Total Population 125. Number of responses 35 { 17-<50 yrs old
18->50 yrs old

1. Are there certain types of equipment that cause problems in your morning preparation, or delays in getting to your therapies?

<50 - .57 <50 - .36 .07 (no answer)
Yes >50 - .52 No >50 - .38 .10 (no answer)

III. Equipment Limitations Affecting Scheduling (cont'd)

- a. That delays were a function of lack of people to assist in your movement?

<50 - .36	<50 - .04	
Yes >50 - .19	No >50 - .66	.15 (no answer)

- b. That delays were due to yourself?

<50 - .64	<50 - .28	.08 (no answer)
Yes >50 - .33	No >50 - .33	.34 (no answer)

2. List below the equipment referred to in (1) above.

<u><50</u>	<u>>50</u>
.57 (elevators filled or not available)	.42 (lack of assistance on elevators or, elevators not available)
.07 (shower chairs)	.05 (x-ray)
.07 (wheel chairs)	.09 (lack of bathroom assistance)
.29 (no answer)	.05 (problems with hand brace and leg brace)
	.05 (wheelchairs)
	.34 (no answer)

D. Related Questionnaire Area - Transportation

Total Population 14 . Number of responses 1 .

1. What is the average volume of "in" and "out" patients moved from:

- a. Floor to floor at each half hour increment, starting at 9:00 a.m.? (Recommend patient flow study)
No Response

- b. The Rehabilitation Institute to Harper and return (on an hourly basis)? (Recommend patient flow study)
No Response

2. What is the average number of patients one transporter can move from the elevator to a given therapy without causing patients to be tardy for their respective activities?

No response

(Recommend time study at both low and peak periods)

III. Equipment Limitations Affecting Scheduling (cont'd)

3. In terms of schedule availability for workload planning purposes, are both "in" and "out" patient schedules available? Yes _____ No ✓
 - a. Which is available? Only in-patients
4. List the other jobs that are required of you during a normal workday, how often you do them, and how much time is required to perform these jobs? No response
5. Does equipment you use for transporting patients effect your ability to get them to their respective destinations on time? Yes _____ No _____
 - a. If so, list the equipment below and indicate the number of times per day (or per week) the equipment is not functional, or is unavailable; and the average amount of time the equipment is not available for service. No response

Note: Transportation is a key element in moving patients from therapy to therapy - therefore, effort should be expended to perform the patient flow studies, personnel workload studies, and equipment limitation studies.

E. Related Area - Equipment and Building and Housekeeping Maintenance

	<u>Total People</u>	<u>No. Responses</u>
Building	3	1
Equipment	1	1

1. In terms of various potentially high failure rate equipment (elevators, ultrasound, diathermy, stimulators, etc.) does failure and subsequent repair time cause delays in service or the movement of patients from one activity to the next:
 - a. Infrequently? Building (.33)
 - b. Half the time? _____
 - c. Frequently? _____
 - d. At random intervals? Equipment (1.0)
 - e. At relatively regular intervals? _____

III. Equipment Limitations Affecting Scheduling (cont'd)

2. List below (from worst to best) the critical equipment affecting patient service and movement.

Building - Elevators (see Note A below)
Equipment - (see Note B below)

3. For the critical equipment listed in (2) above, in terms of equipment availability, indicate the amount of time required to repair the equipment (or find a replacement) and also the time it is allowed to be out of service before effecting patient service or movement. (Recommend time study).

Elevators - 1 - 1.5 hr for repair (see Note A below)
Equipment - (see Note B below)

4. Has any type of logistics support study of the above major components ever been conducted? (This study includes examining stocking of spare parts, spare components, proper training of the users to preclude equipment abuse, determination of preventive maintenance scheduling, etc.)
Yes Building No Equipment

Note A:

Potential Effect of Elevator Outages Given:

- a. 1 - 1.5 hr repair interval
- b. .5 hr between patient therapies
- c. 125 approximately in-patient population

Approximate number half hr therapy sessions lost
 $= 1/.5 \text{ to } 1.5/.5 = 2 - 3$, or an average of 2.5

Due to segregation of therapies from patient floors, a potentially large portion of patients could be prevented from reaching to next therapy session.

Therefore, potential number of half hour therapy sessions lost each time elevator fails = $(2.5) (90)$
 $= 225$ (this does not include out-patient movement).

III. Equipment Limitations Affecting Scheduling (cont'd)

Note B:

Potential Effect of Equipment Outage:

Unit	# Units in hosp	Sched. calib/yr	Unsched. repair/yr	Repair time (hr)		Time between use
				Cal	Cal/repair	
Ult. Sound	4	8	4	2	5	1/15 min
Diathermy	5	10	6	2	5	1/30 min
ECG	3	4	3	2	5	1/2.6 hr
EMG	-	4	1	2	5	1/hr
Defib.	1	1	.5	2	5	-
Total	-	27	14.5	54	112.5	-
Total Number of potential half hr therapy segments lost/yr due to unscheduled maint. = $112.5/2 = 56.25$						

Appendix C

Definition of Symbols

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- E The allowable statistical error, or, estimated accuracy of a mean value (hr).
- Z The number of standard deviation units from the mean (dimensionless).
- σ The standard deviation of a set of values (hr).
- N The statistical sample size required to achieve the desired level of accuracy for given Z factor.